At a Glance

What is it?

■ The Human Robotic Interaction research program focuses on the abilities of teams of humans and autonomous systems to: (1) communicate clearly about their goals, abilities, plans, and achievements; (2) collaborate to solve problems, especially when situations exceed autonomous capabilities; and (3) interact via multiple modalities both locally and remotely.

How does it work?

■ For effective human-robot interaction, it is essential that the robots have good models of the humans they are interacting with and effective mechanisms for human-robot interaction and communication. Roles and responsibilities must be assigned according to the capabilities of both the human and the robot. It must be easy for the human to effect control, to assess the situation, and to assist the robot.

What will it accomplish?

■ This effort will develop the underlying principles and technology that will enable autonomous vehicles and robots to work with people as capable partners.

Points of Contact:

Tom McKenna, (703) 696-4503
tom.mckenna@navy.mil

Behzad Kamgar-Parsi, (703) 696-5754
behzad.kamgarparsi@navy.mil

Marc Steinberg, (703) 696-5115
marc.steinberg@navy.mil

The Navy and Marine Corps are currently investing in a variety of heterogeneous naval unmanned systems to be operated from small naval host platforms or by small Marine Corps units. In many of cases, there will be significant limitations on the manning available for these systems in terms of both numbers and skill types. Increasing the level of automation can have a significant impact on reducing manning requirements. However, despite many advances in autonomous control technologies, mission management often still requires a human's cognitive skills, judgment, decision-making and tactical understanding.
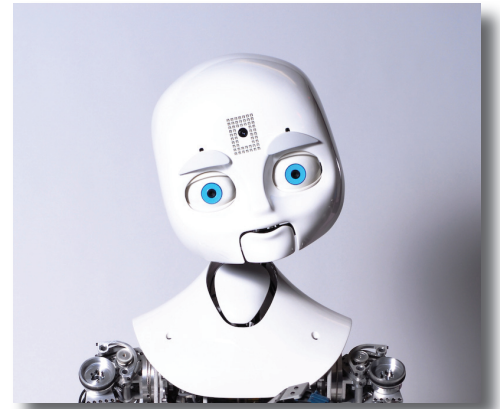
Basic research efforts are currently focusing on areas such as flexible, robust, and scalable human-robot teams in dynamic and uncertain environments, integration of cognitive models, action schemas and statistical estimation, integration of behavior models and distributed control, assigning tasks with different, potentially incompatible goals, and enabling UVs to execute them, robust intuitive multi-modal (natural language, gestures, pointers, etc.) human-robot dialogue systems, and learning from instruction during task execution.

Applied research efforts are focusing on the human interface technology to support small teams of co-located and distributed users in managing larger numbers of unmanned systems and sharing unmanned systems resources, autonomy, decision aids, and situation awareness tools to support collaborative decision-making among teams of operators and unmanned systems, mixed-initiative interfaces, and integrating large amounts of data from multiple sources into unmanned system mission displays.

This research could lead to technology to enable human and robotic teams to effectively remove or disarm IEDs and perform other EOD tasks. It will enable robot sentries to function under conditions that are very hazardous to human sentries. It will enable search of hazardous sites, such as under CBN conditions, and enable searches for concealed CBN items by human-robot teams in a manner that minimizes human risk. This research could also greatly reduce manning requirements for forward-deployed units that were operating unmanned and/or autonomous systems. This technology could increase lethality while reducing manning, per SECDEF directions in the Quadrennial Defense Review.

Research Challenges and Opportunities:

• How can unmanned systems model the human?
• How do we create interfaces that integrate the information from multiple robots into a cohesive display, are intuitive for humans and enable comprehensive interactions among multiple humans and robots, and disseminate information to multiple echelons?
• How is the commander's intent transferred to the robots?
• Who controls the change in autonomy levels as the emergent mission needs dictate?
• What is the collaborative behavior for the use of multiple vehicles between multiple operators who may be sharing resources and assets?

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